Quality Assurance Instruction

TECHNICAL SPECIFICATION HELP AND GUIDELINES

Abstract
This document provides instructions for the preparation of Technical Specification. It is made up of a first part with general recommendations followed by a copy of the Technical Specification template in which hints are included.

An interactive version written in HTML can be found on the WWW in the Quality Assurance pages of the LHC Project (same document number).

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Checked by:
General Recommendations

Terminology
The term **Bidder** is used to address the firm in the first part of the specification dealing with the tender (until the end of section 3.1.7), and the term **Contractor** is used in the second part (from section 3.2 till the end) dealing with the contract execution. Use of any other term, such as supplier or manufacturer should be avoided.

In general, the firm "shall", but CERN "will". Try to avoid "should".

Since the Technical Specification is mainly an engineering document, it is preferable to be consistent throughout and use the abbreviations for units in the text, e.g. 27 km tunnel, and not to intermittently, e.g. in the Abstract and description, put 27 kilometres, although this is perfectly correct English.

Use of capital letters
In both headings and text, capital letters are used for names of persons, organisations, documents, but not events, e.g. bidders' conference. Main headings (heading 1) are written completely with capitals. In all other headings (heading 2 to 4) only the first letter is capital.

The following words take a capital in certain cases, i.e. bidder (for the Bidder use capital B, for a bidder or bidders in general use lower case b):
- bidder
- contractor (not supplier or manufacturer)
- firm
- consortium (applied to any bidder who is a combination or joint venture of two or more firms acting as partners, but not sub-contractors)

The main object of the specification should not have capitals in the text, but can be defined with a capital e.g. the instrumentation wires, hereafter referred to as the "Wires".

Glossary of standard terms (please follow convention for use of capitals)
- commercial documents (not tender documents)
- Instructions to Bidders
- cover letter
- Order (<750 kCHF)
- technical documents
- Technical Description
- Technical Questionnaire
- Technical Specification
- Tender
- Tender Form or Price Enquiry Form
- list of firms
- Contract (>750 kCHF)
- Conforming Bid
- Market Survey
- Qualification Criteria
- Invitation to Tender (refers to the complete set of all documents sent to firms)
- Price Enquiry

For bullet lists there are two formats:
- Capital first letter, mainly for sentences. This is followed by a full stop.
- lower case first letter, mainly for simple lists, this is followed by a comma, until the last one.

Things to remember to do when the Specification is ready:
Select and remove the link to the HELP and GUIDELINES
Check that you have updated all the headers and footers with both the IT number and the LHC Project Document No.
This is done automatically using Macro - Update Doc. Numbers on the LHC Tech. Spec. toolbar. When this is clicked Word will ask you to type in:
- the Group Code
- the EDMS number
- the LHC Project Document number
- the full IT or DO number
- the document date (found on the cover page)
Type in the new value and click OK for the data you want to update, or click cancel if you want the value to remain unchanged.
The Table of Contents, the List of Tables and the List of Figures are also updated by the macro.
Check that you have replaced or removed all XXXX: Menu Edit - Find (or Replace), XXXX
General Recommendations (contd)

Hints on the use of Word:
The correct way to copy text from another document, such as this file, another Word document, a text file etc. is the following:
- select the text in the source document with the mouse
- copy the selected text (crtl -c)
- go to the destination document in Word, place the cursor where the text should go, then paste it; Menu -Edit- Paste special - Unformatted text
Doing it this way ensure that the copied text takes its style from the destination document and not from the source document.

How to insert a figure:
A short description of the procedure to insert illustrations is given below:
Inserting an illustration from a graphic application running on PC's (CorelDraw, designer, PaintShop...)
1. In the graphic application, select and copy the image (crtl-c)
2. In Word, place the cursor where the illustration should go, then Edit - Paste special - Picture, de-select Float over text, OK
Inserting an illustration from a file accessible from the PC
1. In Word, place the cursor where the illustration should go, then Insert - Picture - From file, select the file - Insert
Inserting an illustration which is part of an engineering drawing in CDD
2. See Saving part of a drawing into a new file to prepare the file
3. In Word, place the cursor where the illustration should go, then Insert - Picture - From file, select the file - Insert
Use the macro Insert Figure Caption to add a caption below the figure
Do not forget to insert a List of Figures after the List of Tables. See how it is done.

How to insert an Excel table
1. In Excel, select and copy the cells (crtl-c)
2. In Word, place the cursor where the table should go, then Edit - Paste special - Picture, de-select Float over text, OK
Use the macro Insert Table Caption to add a caption above the table.

Note: Following the ISO/IEC Directives figure captions are placed below figures, and table captions are placed above tables.

How to insert a MS Project Gantt Chart
1. In Microsoft Project, display the Gantt Chart view. Use the scroll bars at the bottom of the sheet and graph areas to adjust the view.
2. Select the information you want to copy.
3. Click the Copy Picture button on the Standard toolbar.
4. In the Copy Picture dialog box, click to select the For Screen option. Click OK.
5. In Word, place the cursor where the Gantt Chart should go, then Edit - Paste special - Picture, de-select Float over text, OK
The Large Hadron Collider Project

IT-XXXX/LHC/LHC

The abstract should mention the planned delivery schedule defined as a number of months or years counted from the notification of the Contract.

Give some idea of the total number or tonnage or size or magnitude.

Replace the month and year on the template by the current month and year.

November 1999
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Table 1 - LHC QAP topics and documents

Terms and Definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDD</td>
<td>CERN Drawing Directory</td>
</tr>
<tr>
<td>EDMS</td>
<td>Engineering Data Management System</td>
</tr>
<tr>
<td>QAP</td>
<td>Quality Assurance Plan</td>
</tr>
</tbody>
</table>

This table lists the definitions necessary for the understanding of certain terms used in the Technical Specification. It should be completed with the abbreviations, acronyms etc. that are used in the specification. Delete the terms that are included in the template if they do not apply.
1. INTRODUCTION

1.1 Introduction to CERN

The European Organization for Nuclear Research (CERN) is an intergovernmental organization with 20 Member States*. It has its seat in Geneva but straddles the Swiss-French border. Its objective is to provide for collaboration among European States in the field of high energy particle physics research and to this end it designs, constructs and runs the necessary particle accelerators and the associated experimental areas.

At present more than 5000 physicists from research institutes world-wide use the CERN installations for their experiments.

1.2 Introduction to the LHC Project

The Large Hadron Collider (LHC) is the next accelerator being constructed on the CERN site. The LHC machine will mainly accelerate and collide 7 TeV proton beams but also heavier ions up to lead. It will be installed in the existing 27 km circumference tunnel, about 100 m underground, that previously housed the Large Electron Positron Collider (LEP). The LHC design is based on superconducting twin-aperture magnets which operate in a superfluid helium bath at 1.9 K.

1.3 Subject of this Technical Specification

2. SCOPE OF THE TENDER

Write a brief overview of all relevant points and explain how the object of this Technical Specification is related to the LHC Machine.

Forms of expression such as the following shall be used:
- specifies ... the dimensions of..., a method of..., the characteristics of...) “
- establishes ... (a system for ..., general principles for ...)”
- gives guidelines for ...

You may wish to refer to a site drawing. See the instructions in the Web help file.

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* CERN Member States are: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, The Netherlands, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland and the United Kingdom.
2.1 Scope of the supply

The scope shall define without ambiguity the subject and the aspect(s) covered by the technical specification, thereby indicating the limits of applicability. It shall not contain requirements.

The scope shall be succinct so that it can be used as a summary for bibliographic purposes.

The scope shall be worded as a series of statements of fact:

- The required supply is as follows:
- ...

Statements of applicability of the Technical Specification shall be introduced by the following wordings:

"This Technical Specification is applicable to..."

You may need to refer to:

<table>
<thead>
<tr>
<th>Design folder</th>
<th>Manufacturing folder</th>
<th>Firm's QAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw material</td>
<td>Manufacture</td>
<td></td>
</tr>
<tr>
<td>Tests</td>
<td>Documentation</td>
<td>Cleaning</td>
</tr>
<tr>
<td>Storage</td>
<td>Packing</td>
<td>Transport</td>
</tr>
<tr>
<td>Installation</td>
<td>Spares</td>
<td>Service</td>
</tr>
<tr>
<td>Guarantee</td>
<td>Samples</td>
<td>Witness samples</td>
</tr>
<tr>
<td>Qualifications</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.2 Items not included in the supply

2.3 Items supplied by CERN

List all items supplied by CERN or by another institute or supplier.

2.4 Long-term conditions

Occasionally you may wish to ask firms to keep tooling or manufacturing resources for a number of years after last delivery.

3. GENERAL CONDITIONS FOR TENDERING AND CONTRACTING

Please refer to the commercial documents for more complete information.

Tenders will only be considered from firms having been selected as qualified bidders by CERN, as a result of the Market Survey ref. xxxx. CERN reserves the right to disqualify any bidder whose reply to this Market Survey is found to have been incorrect.

3.1 Tender procedure

3.1.1 Pre-tender discussions

"All bidders will be invited to attend a bidders’ conference at CERN. One week’s advance notification of such a conference will be given by CERN. Bidders shall cover their own expenses incurred by attending this conference."

The Bidder is strongly encouraged to contact CERN and discuss details of this Technical Specification before submitting a tender. In particular, CERN wishes to ensure that no doubt exists as to the interpretation of this Technical Specification.

3.1.2 Alternative solutions

If the Bidder finds that any part of this Technical Specification is difficult, or costly to meet, he is free to propose an alternative solution, provided that the deviations from this Technical Specification, together with the reasons and advantages, are clearly indicated in the
tender. Such alternative solutions shall always be made in addition to a conforming bid, which must comply fully with this Technical Specification.

CERN reserves the right to accept or reject the proposed alternative solutions without justification.

### 3.1.3 Preliminary programme

The Bidder shall propose a preliminary design and manufacturing schedule with the tender, based on the specified CERN provisional delivery schedule.

### 3.1.4 Subcontractors

The Bidder shall declare in his Tender any subcontractors whose services he intends to use in the event of a Contract. Refer to the commercial documents for more details. If awarded the Contract, the Bidder shall restrict himself both to the subcontractors and the amount mentioned in the Tender. If, for some reason, he wants to change any subcontractor, or the scope of subcontracted work, or the amount subcontracted, he must obtain CERN’s prior agreement in writing.

### 3.1.5 Technical Questionnaire

The Technical Questionnaire attached to this Technical Specification shall be completely filled in and returned with the Tender Form, otherwise the tender will not be considered as complete and will be discarded.

### 3.1.6 Presentation of tender

In many cases this will not be required, or a visit to the Bidder’s premises will be preferable. If required, use this text:

"The Bidder may be required to make a formal presentation of his tender at CERN at his own expense. He shall be ready to do so within a week of notification."

### 3.1.7 Country of origin

Please refer to the commercial documents for specific conditions concerning the country of origin of the equipment or services to be supplied.

### 3.2 Contract execution

#### 3.2.1 Responsibility for design, components and performance

Include the following paragraph if your specification contains any parameters and/or dimensions that may change and are indicated in tables and drawings by the letters T.B.C. (To Be Confirmed):

"CERN reserves the right to make minor modifications to this Technical Specification before placing the Contract. Parameters and/or dimensions, which may change slightly, are clearly indicated in the tables and in the attached drawings by the letters T.B.C. (To Be Confirmed) just beside their actual nominal value. Unless clearly stated by the Bidder in the tender document together with a justification, these minor changes shall not affect the contractual price that shall remain fixed."

The Contractor shall be responsible for the correct performance of all items supplied, irrespective of whether they have been chosen by the Contractor or suggested by CERN. CERN’s approval of the design and component choice does not release the Contractor from his responsibilities in this respect.

CERN assumes responsibility for the performance of items and sub-systems supplied by CERN.
3.2.2 Contract follow-up

3.2.2.1 Contract engineer

The Contractor shall assign an engineer to be responsible for the technical execution of the Contract and its follow-up throughout the duration of the Contract.

3.2.2.2 Progress report

The Contractor shall supply, within one month of notification of the Contract, a written programme detailing the manufacturing and testing schedules. The programme shall include preliminary dates for inspections and tests.

A written progress report shall be sent to CERN every xxxx months until completion of the Contract.

3.2.2.3 Design approval and production

The detailed design shall be submitted to CERN for approval within xxxx months after notification of the contract. CERN will give its approval or refusal, in writing, within xxxx weeks. Component ordering and equipment manufacture shall not start without CERN’s written prior agreement.

The series production shall be preceded by the production of xxxx pre-series units or prototypes. Production of the series shall not start before CERN has given its formal approval of the pre-series or prototypes in writing.

3.2.3 Deviations from this Technical Specification

If, after the Contract is placed, the Contractor discovers that he has misinterpreted this Technical Specification, this will not be accepted as an excuse for deviation from it and the Contractor shall deliver equipment in conformity with this Technical Specification at no extra cost.

During execution of the Contract, all deviations proposed by the Contractor from this Technical Specification, the Tender, or any other subsequent contractual agreement, shall be submitted to CERN in writing. CERN reserves the right to reject or accept such proposals without justification.

CERN reserves the right to modify this Technical Specification during execution of the Contract. The consequences of such modifications shall be mutually agreed between CERN and the Contractor.

3.3 Factory access

CERN and its representatives shall have free access during normal working hours to the manufacturing or assembly sites, including any subcontractor’s premises, during the Contract period. The place of manufacture, as stated in the Tender, may only be changed after written approval by CERN.
4. TECHNICAL REQUIREMENTS

4.1 General description

4.2 Design criteria

4.3 Materials

4.4 Dimensions and tolerances

4.5 Performance

4.6 Safety

4.7 Operational conditions

4.8 Environmental conditions

4.9 Controls

4.10 Information and documentation management

4.10.1 Manufacturing drawings

Manufacturing drawings prepared by the Contractor for the execution of the Contract shall comply with the procedure defined in chapter 8 of the LHC QAP document No LHC-PM-QA-306.00, "Drawing Process-External Drawings".

4.10.2 Planning and scheduling

Planning and scheduling activities shall be performed according to the procedure defined in the LHC QAP document No LHC-PM-QA-301.01, "Planning and Scheduling Requirements for Institutes, Contractors and Suppliers".

4.10.3 Quality control records

All specified tests and measurements carried out during all stages of production, from raw material procurement up to delivery and installation, must be recorded in specific files, collected in the MTF (Manufacturing and Test Folder), according to the procedure defined in the LHC QAP document No LHC-PM-QA-309.00, "Fabrication and Inspection of Purchased Equipment".
5. **APPLICABLE DOCUMENTS**

Please refer to the cover letter or Instructions to Bidders for the complete list of enclosed documents which form part of this Invitation to Tender.

Please note that the quality assurance documents, CERN standards and Purchasing documents referred to in this Technical Specification are on the enclosed CD-Rom entitled "CERN Official Documents".

5.1 **Standards**

The following additional standards are applicable for the execution of the Contract.

5.1.1 **CERN standards**

5.1.2 **International standards**

5.1.3 **National standards**

5.2 **Other references**

If the contract does not require work on the CERN site, the section **On site work regulations** should be removed. The section **Other documents** can be used to list documents that do not fit in the Standards category. It should be removed if it is not used. If both On site work regulations and Other documents are not used, the whole section Other references should be removed.

5.2.1 **On-site work regulations**

If work is to be carried out on the CERN site, attention is drawn to the fact that CERN has specific rules concerning e.g. safety regulations applicable to works of Contractors at CERN, access to and activities on the CERN site, occupational health and safety on the Organization's site and special health and safety matters.

5.2.2 **Other documents**

6. **QUALITY ASSURANCE PROVISIONS**

The Contractor must plan, establish, implement and adhere to a documented quality assurance program that fulfils all the requirements described in this Technical Specification and drawn up according to the Quality Assurance Plan for the LHC Project.

Please note that the quality assurance documents, CERN standards and Purchasing documents referred to in this Technical Specification are on the enclosed CD-Rom entitled "CERN Official Documents".

The list of relevant topics covered by the LHC Quality Assurance Plan, together with the corresponding documents, is given in Table 1 below.
Table 1 - LHC QAP topics and documents

<table>
<thead>
<tr>
<th>Topic</th>
<th>Document Title</th>
<th>Doc. Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy and Organisation</td>
<td>Quality Assurance Policy and Organisation</td>
<td>LHC-PM-QA-100.00</td>
</tr>
<tr>
<td></td>
<td>Glossary, Acronyms, Abbreviations</td>
<td>LHC-PM-QA-203.00</td>
</tr>
<tr>
<td>Planning</td>
<td>Planning and Scheduling Requirements for Institutes, Contractors and Suppliers</td>
<td>LHC-PM-QA-301.01</td>
</tr>
<tr>
<td>Design</td>
<td>Quality Assurance Categories</td>
<td>LHC-PM-QA-201.00</td>
</tr>
<tr>
<td></td>
<td>Design Process and Control</td>
<td>LHC-PM-QA-307.00</td>
</tr>
<tr>
<td></td>
<td>Drawing Management and Control</td>
<td>LHC-PM-QA-305.00</td>
</tr>
<tr>
<td></td>
<td>Drawing Process-External Drawings</td>
<td>LHC-PM-QA-306.00</td>
</tr>
<tr>
<td>Change Control</td>
<td>Configuration Management - Change Process And Control</td>
<td>LHC-PM-QA-304.00</td>
</tr>
<tr>
<td>Manufacturing and Inspection</td>
<td>Manufacturing and Inspection of Equipment</td>
<td>LHC-PM-QA-309.00</td>
</tr>
<tr>
<td></td>
<td>Handling of Non-conforming Equipment</td>
<td>LHC-PM-QA-310.00</td>
</tr>
<tr>
<td></td>
<td>LHC Part Identification</td>
<td>LHC-PM-QA-206.00</td>
</tr>
</tbody>
</table>

The list of documents found in the template is typical for a tender involving engineering design as well as manufacturing and testing of material and/or equipment. Depending on the scope of the tender, the Project Engineer in charge of the Technical Specification has to decide which QA documents are applicable to his specific case and edit the table accordingly.

Guidelines for the selection of QA documents:
In cases where the contractor is not required to carry out detailed engineering design, the following QA documents should be removed from the table:
- Quality Assurance Categories  
  LHC-PM-QA-201.00
- Design Process and Control   
  LHC-PM-QA-307.00
- Drawing Management and Control
  LHC-PM-QA-305.00
- Configuration Management - Change Process And Control
  LHC-PM-QA-304.00

The QA document Drawing Process-External Drawings LHC-PM-QA-306.00 is applicable in all cases where the contractor is required to supply manufacturing drawings based on a CERN or Institute design. It should be removed from the table in cases where the tender does not involve the supply of any drawings.

Any specific quality assurance requirements, should be added in a section 6.1 Specific quality assurance requirements

7. TESTS

If you do not allow the Contractor to sub-contract important tests - state this fact.
In exceptional circumstances, you may say that on request CERN can supply possible sub-contractors' names for specific high technology tests.
Consider making a template for your test results that can be included in the MTF.
For both the tests at the Contractor and the tests at CERN, points 7.1 and 7.2, the test methods and sampling methods (if applicable) should be described.
### TEST METHODS
Including all the instructions concerning the procedure for checking conformity to stated technical requirements and for ensuring reproducibility of the results.
The tests should be identified whether they are: type tests, routine tests, reception tests and so on.
Instructions relating to test methods may be subdivided, where appropriate, in the following order:
principle, materials, apparatus, preparation and preservation of test pieces, procedure, expression of results
(including method of calculation and precision), test report.

### SAMPLING
This should specify the conditions and methods of sampling, as well as the method for the preservation of the sample(s). This element generally appears in a table with the test methods.

### 7.1 Tests to be carried out at the Contractor's premises

<table>
<thead>
<tr>
<th>Checklist:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• List of tests and tests methods</td>
</tr>
<tr>
<td>• Define who is responsible for doing the tests (CERN or the Contractor)</td>
</tr>
<tr>
<td>• Specify who provides the test equipment</td>
</tr>
</tbody>
</table>

CERN reserves the right to be present, or to be represented by an organization of its choice, to witness any tests carried out at the Contractor's or his subcontractors' premises. The Contractor shall give at least 10 working days notice of the proposed date of any such tests.

### 7.2 Tests to be carried out at CERN

<table>
<thead>
<tr>
<th>Checklist:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• List of tests and tests methods</td>
</tr>
<tr>
<td>• Define who is responsible for doing the tests (CERN or the Contractor)</td>
</tr>
<tr>
<td>• Say that if the Contractor does not wish to be present he may send a representative at his own expense</td>
</tr>
</tbody>
</table>

### 8. DELIVERY AND COMMISSIONING

#### 8.1 Provisional delivery schedule
Outline the delivery schedule in weeks/months from the placement of the contract. Dates are given in the commercial papers.

#### 8.2 Packing and transport to CERN
The Contractor is responsible for the packing and, where included, the transport to CERN. He shall ensure that the equipment is delivered to CERN without damage and any possible deterioration in performance due to transport conditions.

#### 8.3 Handling at CERN

##### 8.3.1 CERN supplied items and services
Specify all particular requirements and special conditions regarding packing, maximum acceleration during transport and so on.
Clarify CERN supplied items and services.

##### 8.3.2 Contractor’s installations at CERN
Specify delivery to CERN, exact details concerning Meyrin or Prévessin will be included in the commercial documents.
Please refer to section 5.2.1.
8.4 Commissioning

8.5 Acceptance and guarantee

Provisional acceptance will be given by CERN only after all items have been delivered in accordance with the conditions of the contract including documentation referred to in this Technical Specification, all tests specified have been successfully completed and all test or other certificates have been supplied to CERN.

The guarantee period is defined in the commercial documents.

8.6 Service

- Maintenance: define preventive maintenance, schedules, spare parts, if on-site, if transport needed, manpower, etc.
- On-site service: intervention time etc.
- If software is included in the supply, what are the conditions concerning upgrades etc.

8.6.1 Maintenance

8.6.2 On site service

8.6.3 Training

9. CERN CONTACT PERSONS

Persons to be contacted for technical matters:

<table>
<thead>
<tr>
<th>Name/Division/Group</th>
<th>Tel-Fax</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tele: _______________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fax: _______________</td>
<td></td>
</tr>
<tr>
<td>In case of absence:</td>
<td>Tele: _______________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fax: _______________</td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Name/Division/Group</th>
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<th>Email</th>
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Annex A:  List of Drawings

Annexes where the content of the annex is part of the specification document, such as a list of drawings or a short text, should be separated by a page break. Annexes that are references to separate documents may be listed on the same page.

Annex A: List of drawings
You may wish to send drawings on a CD-ROM. In that case the CD-ROM will contain:
1) copies of the drawings in HPGL format (exactly what is stored in CDD and printed on paper copies)
2) a copy of the viewer on the CD so that the recipient sees exactly what we see and print.
The recipient of the CD must be told that in case of doubt he should refer to the paper copy (telling him it is the responsibility of the CERN engineer or designer.)

It is recommended that the drawings are listed with their revision index to prevent confusion about which revision of the drawings is applicable.

A list of drawings, including drawing number, revision index and title can be prepared automatically from CDD. See the Web help file.

Annex B:  CD-ROM "CERN Official Documents"

A link to the full list of documents of the CD-ROM "CERN Official Documents" can be found in the Web help file.